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SERVICE DISCOVERY IN A NETWORK OF AUTOMATIC
PRODUCT/SERVICE DISPENSING MACHINES

BACKGROUND OF THE INVENTION

1.   Technical Field:

The present invention relates to computer software and, more particularly, to methods of distributing products via automatic product dispensing machines.

2.   Description of Related Art:

Automatic product dispensing machines (i.e. vending machines) are a useful mechanism by which to serve customers through instantaneous dispensation of chosen products. However, the exhaustion of a machine's supply of a specific item can be a source of irritation and aggravation to the user who has traveled to the machine in search of that specific product or has to settle for another product. Also, many times the operator of the vending machines simply loses a potential sale due to the user giving up on finding the desired product.

Currently, it is possible to find out about services in wide area networks (WANs) or the Internet using Wireless Application Protocol (WAP) (e.g., find out about Chinese restaurants within a three mile radius of the current location). Such services are typically very broad (e.g., it will be hard or impossible to find a service that provides information about where to find a specific menu item, such as dumplings). Moreover, such services are not available in micronetworks, as in buildings or other similar environments. Therefore, it would be desirable to provide a system, method, and

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computer program product for providing and/or redirecting a user to an appropriate machine or location at which the user may obtain the services or products desired.

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SUMMARY OF THE INVENTION

5   The present invention provides a method, system, and computer program product for providing products to a user via an automated product dispensing machine. In once embodiment, an automatic product dispensing machine in a micronetwork of proximally located diverse automatic

10   product dispensing machines receives a request for an item. Responsive to a determination that the item is unavailable at a current automatic product dispensing machine, the automatic product dispensing machine provides a user with an alternative redemption product,

15   such as, for example, a coupon that may be redeemed at another automatic product dispensing machine or at a nearby store.

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BRIEF DESCRIPTION OF THE DRAWINGS

5   The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in

10   conjunction with the accompanying drawings, wherein:

Figure 1 depicts a block diagram of an automated product dispensing system in accordance with the present invention;

Figure 2 depicts a block diagram of an alternative

15   APD system in accordance with the present invention;

Figure 3 depicts a block diagram of a data processing system that may be implemented as a server in accordance with a preferred embodiment of the present invention;

Figure 4 depicts a block diagram of a APD machine in

20   accordance with the present invention;

Figure 5 depicts an exemplary process flow and program function updating inventories in an APD system in accordance with the present invention;

Figure 6 depicts an exemplary process flow and

25   program function for redirecting a user from an APD machine incapable of satisfying a user's request to another APD Machine capable of satisfying the user's request in accordance with the present invention;

Figure 7 depicts an exemplary process flow and

30   program function for handling, in an APD machine, a redirected transaction from another APD machine in accordance with the present invention;

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Figure 8 depicts a block diagram of a system for allowing a user to discover available services and products within an APD system in accordance with the present invention;

5   **Figure 9** depicts a block diagram illustrating a data processing system in which the present invention may be implemented;

Figure 10 depicts an exemplary process flow and program function for allowing a user to discover the

10   location of products and services available within a micronetwork in accordance with the present invention;

Figure 11 depicts a message flow diagram illustrating the discovery of services available in an environment served by a micronetwork in accordance with

15   the present invention; and

Figure 12 depicts a message flow diagram illustrating the process of registering an APD machine with a service discovery gateway in accordance with the present invention.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to **Figure 1**, a block diagram of
5   an automated product dispensing system is depicted in
accordance with the present invention. Automated product
dispensing (APD) system **100** is a system for automatically
dispensing products, coupons, or services. For example,
APD system **100** may be a system for vending soft-drinks,
10   snack foods, coupons, and/or tickets. However, these are
only a few of the more common products and services
dispensed using APD system **100**. Many other products and
services may be used in conjunction with APD system **100**.
Therefore, the present invention is not limited to the
15   products and services enumerated above.

APD system **100** includes a central server **102** that is
connected to or includes management tools **106**, alert
mechanism **108**, and database **104**. Database **104** stores the
available inventory of each APD machine **118, 118**, and **120**
20   within APD system **100**. Management tools **106** manages the
inventory of each APD machine **116, 118**, and **120** within
APD system **100**. The alert mechanism **108** alerts an
identified one of APD machines **116, 118**, and **120** of a
redirection and coupon or discount to be applied if a
25   user selects a product or service from one APD machines
116, 118, and **120** that is unable to satisfy the user's
request. Central server **102** is connected **112-114** to a
plurality of APD machines **116, 118, 120** through network
110. Network **110** may be, for example, a micro area
30   network, a local area network (LAN), a wide area network
(WAN), the Internet, or a wireless network.

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An APD machine **120** includes a machine front end **128** and a machine back end **122**. The machine front end **128** includes a panel **130** for a user to interface with the APD machine **120** and product or service stocks **132**. The panel

5   **130** allows a user to select a desired product or service from the products or services offered by the APD system **100** as well as provides a means for receiving payment from the user. The means for receiving payment may be, for example, a receptacle and mechanism for receiving

10   coins and/or paper currency, determining the amount received and providing change if necessary. The means for receiving payment may also be a card reader for reading a credit, charge, debit card, or smart card. Other embodiments may include means for receiving

15   electronic funds through the user of wireless electronic devices such as, for example, wireless telephones and personal digital assistants (PDAs). Means, such as those enumerated above, for collecting payment are well known in the art. Once payment is received, products or

20   services are dispensed to the user from available stocks **132**.

The machine back end **122** includes an embedded server **124** and an embedded database **126**. The embedded server **124** monitors the available inventory of products and/or

25   services available in the APD machine **120** and updates an inventory stored in embedded database **126** as changes occur to the available stock **132**. Embedded server **124** also communicates with central server **102** to update the central server **102** with current inventories. Central

30   server **102** then updates its database **104** with the updated inventory from APD machine **120**. Database **104** also

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contains inventory information about the available stocks of products and/or services in other APD machines **116** and **118** within APD system **100**.

If a user requests a product or service currently
5   unavailable within APD machine **120**, a message is sent from APD machine **120** to central server **102** notifying the server **102** that a product that is unavailable from the current APD machine **120** has been requested by a user and requesting that the central server **102** provide the
10 identity and location of an alternative APD machine **116** and **118** from which the user may obtain the desired product and/or service. The central server **102** then identifies another APD machine **116** and **118** that is able to fulfill the user's request. The identity and location
15 of the alternative APD machine **116** or **118** is sent to APD machine **120** and presented to the user through panel **130**. The central server may identify only one alternative, no alternatives, or several alternative.

Once the user has been presented with the
20 notification that the selected product is unavailable at the current location, the user may then select an alternative product from the current APD machine **120** or may select the alternative option provided by central server **102**, or decide to abandon the transaction
25 altogether. If the user selects the alternative provided by central server **102**, then, if there are more than one potential options, the user is asked to select the specific option. The user is then presented with the identity and location of the alternative APD machine **116**
30 or **118** and possibly with a coupon redeemable at the alternative location to compensate for and appease the

user's dissatisfaction at being unable to obtain the desired product at the current APD machine **120**. The location information provided to the user may include a map or directions on how to travel to the alternative APD

5 machine **116** or **118** from the current APD machine. In some embodiments, this location information may be provided to the user before asking the user to select an alternative, thus allowing the user to determine whether the alternative is close enough to be worth, in the judgment

10 of the user, traveling.

The alternative APD machine **116** or **118** selected by the user is then notified of the selection by central server **102** after the central server **102** has been notified by APD machine **120**. The alternative APD machine **116** or

15 **118** is also notified of any coupons dispensed to or credited to the user. For example, if the user uses a smart card, electronic device, credit card, charge card, or debit card, the central server **102** may send identity information about the payment device to the alternative

20 APD machine **116** or **118**. Thus, when the alternative APD machine **116** or **118** is presented with the payment device previously used by the user at the first APD machine **120**, the alternative APD machine **116** or **118**, with notice of an appropriate coupon or discount value to be given to the

25 user, will deduct an appropriate amount from the price of the selected product or service and charge the user the adjusted lower price for the product or service.

Thus, by redirecting the user to another APD machine within the APD system **100**, the operators avoid losing a

30 potential transaction because of the unavailability of a product at a particular APD machine **116**, **118**, and **120**.

Furthermore, the user is satisfied because, rather than having to select an alternative product not as well liked by the user or having to not receive the chosen product at all, the user is directed to a location that is able
5   to satisfy the user's request. Also, although a coupon or discount does not have to be dispensed, the operator of the APD system **100** may wish to provide the user with a discount or coupon to generate good will.

In circumstances in which a coupon is dispensed
10 along with the redirection, in order to prevent user's from taking advantage of the system, the APD system **100** may limit the number of coupons a given user may receive during any given time period. Thus, a user may be prevented from deliberately seeking out and selecting an
15 APD machine **116, 118,** and **120** that the user knows cannot satisfy his request just to obtain a discount or coupon on the item. Also, in some embodiments, the discount or coupon may have a valid time period associated with it such that it is only valid for some short time after the
20 user attempts but is unable to obtain a product from a particular APD machine **116, 118,** and **120.** Thus, user's are prevented from obtaining coupons and/or discounts for products or service, that a user has no current desire for, but merely to have a discount on the item at some
25 later time when the user desires to purchase the product or service.

APD system **100** has been described primarily in terms of obtaining a product or service not currently available at a given APD machine **116, 118,** and **120** with an
30 implication that the given APD machine **116, 118,** and **120** is currently out of the product or service, but sometimes contains the product or service. However, the present

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invention is not limited to the case in which an APD
machine is currently out of an inventory item normally
stocked, but may also include situations in which a
particular APD machine **116, 118,** and **120** does not ever or

5   seldom ever carries the requested product, but other APD
machines **116, 118,** and **120** within APD system **100** do. In
such circumstance, the user would be directed to an
appropriate APD machine **116, 118,** and **120** in the same
fashion as described above.

10   APD system **100** is provided merely as an example of
an APD system and is not meant to imply any architectural
limitation to the present invention. For example, APD
system **100** may include many more APD machines than
depicted in **Figure 1.** Furthermore, rather than providing

15   a user with discounts or coupons, other incentives may be
utilized to encourage the user to travel to an alternate
APD machine and purchase a product or service from the
alternate APD machine.

        With reference now to **Figure 2,** a block diagram of

20   an alternative APD system is depicted in accordance with
the present invention. APD system **200** is similar to APD
system **100** and contains the same components. However, in
addition to the ability of the APD machines **116, 118,** and
120 to communicate **112-114** directly with central server

25   **102,** APD machines **116, 118,** and **120** may also communicate
140-142 directly (i.e. peer-to-peer communications) with
each other. Therefore, if an APD machine receives a
request that it is unable to satisfy, the APD machine
116, 118, or **120** may communicate directly with the other

30   APD machines **116, 118,** and **120** to determine the identity
and location of an alternative APD machine **116, 118,** and

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120 that is capable of satisfying the user's request.

Referring to **Figure 3,** a block diagram of a data processing system that may be implemented as a server, such as central server **102** or as embedded server **124** in

5   **Figures 1** and **2,** is depicted in accordance with a preferred embodiment of the present invention. Data processing system **300** may be a symmetric multiprocessor (SMP) system including a plurality of processors **302** and **304** connected to system bus **306.** Alternatively, a single

10   processor system may be employed. Also connected to system bus **306** is memory controller/cache **308,** which provides an interface to local memory **309.** I/O bus bridge **310** is connected to system bus **306** and provides an interface to I/O bus **312.** Memory controller/cache **308** and

15   I/O bus bridge **310** may be integrated as depicted.

Peripheral component interconnect (PCI) bus bridge **314** connected to I/O bus **312** provides an interface to PCI local bus **316.** A number of modems may be connected to PCI local bus **316.** Typical PCI bus implementations will

20   support four PCI expansion slots or add-in connectors. Communications links to clients **116-120** in **Figure 1** may be provided through modem **318** and network adapter **320** connected to PCI local bus **316** through add-in boards.

Additional PCI bus bridges **322** and **324** provide

25   interfaces for additional PCI local buses **326** and **328,** from which additional modems or network adapters may be supported. In this manner, data processing system **300** allows connections to multiple network computers. A memory-mapped graphics adapter **330** and hard disk **332** may

30   also be connected to I/O bus **312** as depicted, either directly or indirectly.

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Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 3** may vary. For example, other peripheral devices, such as optical disk drives and the like, also may be used in addition to or in

5   place of the hardware depicted. The depicted example is not meant to imply architectural limitations with respect to the present invention.

The data processing system depicted in **Figure 3** may be, for example, an IBM e-Server pSeries system, a

10 product of International Business Machines Corporation in Armonk, New York, running the Advanced Interactive Executive (AIX) operating system or LINUX operating system.

With reference now to **Figure 4,** a block diagram of a

15 APD machine is depicted in accordance with the present invention. APD machine **400** is an example of an APD machine that may be implemented as, for example, any of APD machines **116, 118,** and **120** depicted in **Figures 1** and **2.** APD machine **400** includes an embedded server **418**

20 connected to an embedded database **420,** products **412,** accounting unit **414,** price database **416,** and human-machine interface **402.**

Embedded server **418** communicates with a central server and may also communicate with embedded servers

25 within other APD machines. The current product contents of the current APD machine are stored in embedded database **420.** The current product contents of other APD machines in the system may also be contained within embedded database **420.** As products are purchased by users, the

30 database **420** is updated. Products **412** contains the products offered by the APD machine **400** and is connected

to accounting unit **414** that debits inventory and credits accounts as products are purchased by users. Accounting unit **416** is connected to a price database **416** that contains the current price charged for each product

5 contained in products **412**.

Human-Machine interface **402** contains a product selection panel, a payment mechanism, and a product dispenser **410**. Product dispenser **410** dispenses the chosen product, if available, to the user. Product dispensers

10 for use with APD machines are well known in the art. The product selection panel **404** allows a user to select a product or service from the APD machine **400**. Product selection panel **404** also includes a customer redirection and incentive unit **406** which allows the APD machine **400** to

·15 notify a user that a product or service is unavailable, inform the user of alternative APD machines, and provide an incentive, such as a coupon, for the inconvenience of traveling to another APD machine. Payment mechanism **408**, as described above, may be any of many different types of

20 payment mechanisms, and many different types of payment mechanisms are well known in the art.

With reference now to **Figure 5,** an exemplary process flow and program function updating inventories in an APD system is depicted in accordance with the present

25 invention. To begin, each APD machine in the APD system as well as the central server is setup (step **502**). The peer state repository is loaded on each APD machine (step **504**). The peer state repository contains the information about the inventory and products available on each APD

30 machine. Next, the peer state repositories are loaded onto the central server (step **506**). Peers then

periodically communicate with each other to exchange state information (step **508**). The peer then determines whether new state information has been received from another peer (step **510**). If no new information has been received, then

5 the peer continues to periodically communicate with the other peers (step **508**). If new information has been received from a peer, then the peer state repository is updated (step **512**) and the APD machine continues to communicate with the other peers (step **508**).

10   With reference now to **Figure 6,** an exemplary process flow and program function for redirecting a user from an APD machine incapable of satisfying a user's request to another APD Machine capable of satisfying the user's request is depicted in accordance with the present

15 invention. To begin, the APD machine is set up to handle peer-to-peer exchange of states (step **602**). Alternatively, the APD machine can be set up to send state information to the central server and receive state information about other APD machines from the central

20 server. Next, a user makes a selection (step **604**). The APD machine then determines whether it can satisfy the user request (step **606**). If the APD machine can satisfy the user request, then the product is dispensed (step **608**) and the product database is updated (step **620**). The APD

25 machine then determines whether the user wishes to make another selection (step **622**). If yes, then the APD machine continues with step **604.** If no, then the process ends.

      If the APD machine cannot satisfy the user's request,

30 then it determines the state of peer set of APD machines (step **610**) and determines whether one of the peer APD

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machines can satisfy the user's request (step **612**). If no peer can satisfy the user's request, the user is asked whether another transaction is desired (step **622**). If yes, then the APD machine continues with step **604** and the
5   process ends if the user does not desire another transaction.

   If a peer can satisfy the user's request, then the APD machine redirects the user to the nearest APD machine capable of satisfying the user's request (step **614**). The
10 appropriate economic incentives, if any, are then applied to the user (step **616**) and the peer APD machine is informed of the impending user as well as any incentive offered (step **618**). The APD machine then records the redirected transaction (step **620**) and determines whether
15 the user wishes to make another transaction (step **622**). If the user does desire another transaction, then the APD machine continues with step **604**. If the user does not desire any further transactions, then the process ends.

   With reference now to **Figure 7,** an exemplary process
20 flow and program function for handling, in an APD machine, a redirected transaction from another APD machine is depicted in accordance with the present invention. To begin, the APD machine is set up to communicate with peers either directly or through exchanging information with a
25 central server (step **702**). The APD machine then enters a normal mode of operation (step **704**) and determines whether a request to handle a redirection has been received (step **706**). If no request to handle a redirection has been received, then the APD machine continues with normal
30 operation (step **704**).

   If a request to handle a redirection has been

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received, then the APD machine receives information from the redirecting machine about the product requested, discount offered, and any other pertinent information (step **708**). The APD machine then waits for the redirected

5   user to make a selection (step **710**) and determines whether a selection has been made (step **712**). If no selection has been made by the redirected user, then the APD machine continues to wait (step **710**). If a selection has been made by the redirected user, then the product is dispensed

10 (step **714**). The transaction is then recorded in the local database and other relevant databases, such as, for example, the central server database or the local database of other APD machines, are updated (step **716**).

With reference now to **Figure 8,** a block diagram of a

15 system for allowing a user to discover available services and products within an APD system is depicted in accordance with the present invention. Service discovery system **800** includes a central server **826** connected to a central database **828,** a service discovery gateway **822**

20 connected to a service registry **824,** APD machines **808** and **814,** and network **820.** The service discovery gateway **822** maintains service provision records in the registry **824** and keeps updated states. Thus, the service discovery gateway **822** uses and maintains the service registry **824**

25 to maintain an accurate reflection of currently available services in the micronetwork (e.g., a building). Service providers, such as, for example, an APD system with central server **826** and APD machines **808** and **814,** may register (or deregister) their services and products with

30 the service registry **824.** The service registry **824** contains information about providers and their services

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and also receives updates about provided services and possible state changes.

Network **820** may be, for example, a micro network, a local area network (LAN), or a wireless network such as, for example, Bluethooth, and provides means for communication between the central server **826**, service discovery gateway **822**, APD machines **808** and **814**, and with clients **802, 804,** and **806.** Each APD machine **808** and **814** includes an embedded server **810** and **816** and an embedded database **812** and **818.** The central server **826**, central database **828**, and APD machines **808** and **814** function as described above with reference to **Figures 1** and **2.**

Upon entering an environment such as, for example, a building, theme park, or some other relatively small or self contained environment, a user may use a client **802, 804,** or **806** to query a service discovery gateway **822** about the location of available services, which in the depicted case would be the location of APD machines **808** and **814** and the available products by the APD machines **808** and **814.** Client **802, 804,** and **806** may access the service discovery gateways **822** using, for example, Bluetooth, Infrared Data Association protocol (IrDA), Service Location Protocol (SLP), or similar protocols, to specify and discover available services and invoke them.

Thus, a user can walk into an unfamiliar environment, such as, for example, a building, and using a portable data processing system, such as any of client **802, 804,** and **806** access the service discovery gateway **822** to discover the location of a vending machine, such as APD machine **814** that contains, for example, a certain type and brand of soft-drink. If the user has an

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infrared (IR) transmitter and receiver on the portable
data processing system, then the user can aim the IR
transmitter at a IR receiver and transmitter
appropriately marked in the entrance or other area of the
5   building to access the service discovery gateway **822.**
Alternatively, the user may enter a web universal
resource locator (URL) associated with the service
discovery gateway into a web browser and obtain access to
the service discovery gateway via the Internet. Many
10   other methods of accessing the service discovery gateway
will be obvious to one of ordinary skill in the art.
Once accessed, the service discovery gateway **822** may
access the service registry **824** to discover matching
services to the user's request and return to the user a
15   reply specifying the location at which the user's
requested product or service may be found within the
micronetwork (e.g. the building) or with a message
indicating that the requested product or service (e.g.,
soft-drink) is not available.
20   Service discovery system **800** is intended as an
example of service discovery system **800** and not as an
architectural limitation. Other components not shown may
be used in place of or in addition to components depicted
in **Figure 8.**
25   With reference now to **Figure 9,** a block diagram
illustrating a data processing system is depicted in which
the present invention may be implemented. Data processing
system **900** is an example of a client computer which may be
implemented as, for example, any of clients **802, 804,** and
30   **806** in **Figure 8.** Data processing system **900** employs a
peripheral component interconnect (PCI) local bus
architecture. Although the depicted example employs a PCI

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bus, other bus architectures such as Accelerated Graphics Port (AGP) and Industry Standard Architecture (ISA) may be used. Processor **902** and main memory **904** are connected to PCI local bus **906** through PCI bridge **908**. PCI bridge **908**

5 also may include an integrated memory controller and cache memory for processor **902**. Additional connections to PCI local bus **906** may be made through direct component interconnection or through add-in boards. In the depicted example, local area network (LAN) adapter **910**, SCSI host

10 bus adapter **912**, and expansion bus interface **914** are connected to PCI local bus **906** by direct component connection. In contrast, audio adapter **916**, graphics adapter **918**, and audio/video adapter **919** are connected to PCI local bus **906** by add-in boards inserted into expansion

15 slots. Expansion bus interface **914** provides a connection for a keyboard and mouse adapter **920**, modem **922**, and additional memory **924**. Small computer system interface (SCSI) host bus adapter **912** provides a connection for hard disk drive **926**, tape drive **928**, and CD-ROM drive **930**.

20 Typical PCI local bus implementations will support three or four PCI expansion slots or add-in connectors.

An operating system runs on processor **902** and is used to coordinate and provide control of various components within data processing system **900** in **Figure 9**. The

25 operating system may be a commercially available operating system, such as Windows 2000, which is available from Microsoft Corporation. An object oriented programming system such as Java may run in conjunction with the operating system and provide calls to the operating system

30 from Java programs or applications executing on data processing system **900**. "Java" is a trademark of Sun

Microsystems, Inc. Instructions for the operating system, the object-oriented operating system, and applications or programs are located on storage devices, such as hard disk drive **926,** and may be loaded into main memory **904** for

5 execution by processor **902.**

Those of ordinary skill in the art will appreciate that the hardware in **Figure 9** may vary depending on the implementation. Other internal hardware or peripheral devices, such as flash ROM (or equivalent nonvolatile

10 memory) or optical disk drives and the like, may be used in addition to or in place of the hardware depicted in **Figure 9.** Also, the processes of the present invention may be applied to a multiprocessor data processing system.

15 As another example, data processing system **900** may be a stand-alone system configured to be bootable without relying on some type of network communication interface, whether or not data processing system **900** comprises some type of network communication interface. As a further

20 example, data processing system **900** may be a personal digital assistant (PDA) device, which is configured with ROM and/or flash ROM in order to provide non-volatile memory for storing operating system files and/or user-generated data.

25 The depicted example in **Figure 9** and above-described examples are not meant to imply architectural limitations. For example, data processing system **900** also may be a notebook computer or hand held computer in addition to taking the form of a PDA. Data processing

30 system **900** also may be a kiosk or a Web appliance.

With reference now to **Figure 10,** an exemplary process flow and program function for allowing a user to

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discover the location of products and services available within a micronetwork is depicted in accordance with the present invention. To begin, a user enters an environment served by a micronetwork of APD machines

5   (step **1002**). A process of discovery, such as, as discussed above, pointing an IR device at an identified IR transmitter/receiver associated with the service discovery gateway (SDG), is used to locate the SDG so that the SDG and user can communicate to locate services

10   and/or products (step **1004**). The user then submits a query (step **1006**) and sends the query to the SDG (step **1008**).

The SDG formulates the query appropriately and submits the query to the service discovery registry for a

15   response (step **1010**). The available services are received by the SDG from the registry (step **1012**) and the SDG determines whether the service can by invoked remotely (step **1014**). If the service cannot be invoked remotely, then an APD machine is informed about the

20   user's request (step **1016**) and the APD machine begins communicating directly with the user (step **1018**). The APD machine then sends location information and invocation mechanisms to the user (step **1020**). The user then invokes the services, such as selecting a soft-drink

25   from the APD machine, (step **1022**) and is informed of the status of the request (e.g., whether the soft-drink has been dispensed, will be dispensed shortly, where to pick up the soft-drink, etc.) (step **1024**). The user is then charged and accounting for the APD machine is updated

30   (step **1026**).

If the service can be invoked remotely, then the

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service invocation is performed remotely (step **1028**) and the user informed of the status of the requested service (step **1030**). The user is then charged and appropriate accounting components updated (step **1026**).

5   In other embodiments, rather than remotely invoking services on other automated product dispensing machines within the network, the automated product machine, upon receiving a request for an item it does not have currently in stock, may provide the user with a

10   redemption coupon for the requested product or service or for an alternative product or service. The coupon may be a physical coupon or an electronic coupon and may be redeemed at other ones of the automated product dispensing machines or at a nearby store or cafeteria.

15   Alternatively, the APD machine may dispense an alternative product at a discount or may provide a monetary credit to the user's smart card for the inconvenience of not obtaining the desired product.

        In other embodiments, rather than waiting for a user

20   to select a product, the APD machine may detect the presence of a portable data processing system, using, for example, bluetooth, and push information regarding product availability, product location, product pricing, as well as other product information to the user's data

25   processing system when the user enters the proximity of the micronetwork of APD machines.

        With reference now to **Figure 11,** a message flow diagram illustrating the discovery of services available in an environment served by a micronetwork is depicted in

30   accordance with the present invention. To begin, a user client **1106** queries **A1** the SDG **1104** to find about requested services. The SDG **1104** consults **A2** a service

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discovery registry and responds **A3** to the user client **1106** with service information. The user client **1106** then sends **A4** a message to APD machine **1102** invoking the requested service using information received from the SDG

5   **1104.**   The APD machine **1102** responds **A5** with the requested services or information about how to complete the requested service.

With reference now to **Figure 12,** a message flow diagram illustrating the process of registering an APD

10 machine with a service discovery gateway is depicted in accordance with the present invention. To begin, the SDG **1202** discovers a new APD machine **1206** within the micronetwork and sends a message **B1** to the APD machine **1206** offering to it the SDG services and describing the

15 offered services. The APD machine **1206** then sends **B2** a response to the SDG **1202** with information about the services and/or products offered by the APD machine **1206.** the APD machine **1206** also sends **B3** a message to the central server **1204** informing the central server **1204**

20 about the service offer received from SDG **1202** and the APD machine's response.

Upon receiving the response **B2** from APD machine **1206,** the SDG **1202** updates **B4** its service registry with information about the location of the APD machine **1206**

25 and its associated services and/or products. The central server **1204,** upon receiving the message **B3** from the APD machine **1206,** updates **B5** its database with information regarding the SDG **1202.** The SDG **1202** then sends a message **B6** informing the APD machine that it is now

30 included in the service discovery registry.

It is important to note that while the present

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invention has been described in the context of a fully
functioning data processing system, those of ordinary
skill in the art will appreciate that the processes of
the present invention are capable of being distributed in
5   the form of a computer readable medium of instructions
and a variety of forms and that the present invention
applies equally regardless of the particular type of
signal bearing media actually used to carry out the
distribution. Examples of computer readable media
10 include recordable-type media, such as a floppy disk, a
hard disk drive, a RAM, CD-ROMs, DVD-ROMs, and
transmission-type media, such as digital and analog
communications links, wired or wireless communications
links using transmission forms, such as, for example,
15 radio frequency and light wave transmissions. The
computer readable media may take the form of coded
formats that are decoded for actual use in a particular
data processing system.

The description of the present invention has been
20 presented for purposes of illustration and description,
and is not intended to be exhaustive or limited to the
invention in the form disclosed. Many modifications and
variations will be apparent to those of ordinary skill in
the art. The embodiment was chosen and described in
25 order to best explain the principles of the invention,
the practical application, and to enable others of
ordinary skill in the art to understand the invention for
various embodiments with various modifications as are
suited to the particular use contemplated.

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